SCIENCE.

FRIDAY, OCTOBER 22, 1886.

COMMENT AND CRITICISM.

THE LARGE NUMBER of persons who are interested in the subjects of prison labor and prison management generally look forward to the second annual report of the national bureau of labor with great interest: for it has been announced that in this report Col. Carroll D. Wright, the able and experienced chief of the bureau, will give the results of his investigations, made personally and by special agents, into the question of labor in prisons in all its forms and its relations to labor outside. In his circular of instructions to agents, Colonel Wright enumerates four systems of prison labor in the United States, and defines them, — the contract system, the piece-price system, the public account system, and the lease system. The inquiries made cover the kind, grade, and value of the goods produced, the number of hours of daily labor required, the number of convicts employed in productive labor, the number of free laborers necessary to perform the work, and the average wages of free laborers. Colonel Wright also wants to know the number of convicts idle or employed in prison duties, the aggregate number, their average age, the average length of sentences, the amount received by convicts for working over-time, and the receipts and expenses of the institution. The inquiry is meant to throw light upon the following points: 1°, the influence of the labor of convicts upon free labor; 2°, the influence of the various systems in use upon the criminal; 3°, the general conditions under which the work is carried on. This question of convict labor is a wide and complicated one, concerning which we need, above all else, to know the exact facts, inasmuch as it has of late taken on a political aspect as a result of the representatives of certain classes of the community. We can trust Colonel Wright's ability and integrity to procure and lay before us these facts.

THE POPULAR GENIALITY of Mr. Grant Allen's scientific writings has perhaps seldom found so appropriate a theme as the one discussed by him in the October issue of the *Fortnightly review*, — a theme, by the way, not at all suggestive of a scientific article; namely, 'Falling in love.' The article was called out by the following sentence in the address of the president of the anthropological section, Sir George Campbell, at the recent meeting of the British association: "Probably we have enough physiological knowledge to effect a vast improvement in the pairing of individuals of the same or allied races, if we could only apply that knowledge to make fitting marriages, instead of giving way to foolish ideas about love and the tastes of young people, whom we can hardly trust to choose their own bonnets, much less to choose in a graver matter in which they are most likely to be influenced by frivolous prejudices." The question is a serious one; for it raises the issue whether the time-honored instinct of falling in love is a useful one or not; whether an artificial system of pairing would accomplish the object, the amelioration of the race, better and more directly.

Mr. Grant Allen decides that this most involved exemplification of the universal selective process is thoroughly efficient: for we cannot fall in love with everybody alike; and the person with whom we do fall in love, as is shown by the fact that in nine cases out of ten it is a reciprocal affection, is to some extent our physical, moral, and mental complement. In this way too close likeness is avoided, and the great means of betterment — variation — is insured. Moreover, it is the biologically excellent traits that are sexually attractive, — youth, beauty, strength, health. So strong ought our faith to be in the efficiency of this curious, vague, and unfathomable instinct, that it should be our aim to discountenance all but marriages on the principle of spontaneous affection. It is the marriage on the basis of money, of rank, or other practical reasons, that results in deterioration. In short, the old theme of the novelists and poets is justified against the rather crass precept of the modern scientist. But a word for the latter should be added. It is, that, without any artificial interference, the public sentiments, so influential in the guidance of the sexual selections, can be unconsciously guided into the channels which science points out as the best. Science should and

can not prevent people from falling in love; but can it not so influence public opinion as to make falling in love even a more efficient and beneficial process of selection than it now is?

THAT THE LAWS which now exist for the protection of the ignorant, both poor and rich, against quacks and charlatans, are totally inadequate to that end, must be painfully evident to every one who keeps himself at all informed on the general news of the day. It is not long ago that one death was caused by the application of kerosene, and another by the fluid extract of the St. Ignatius bean. Within the present year a strong, robust farmer in middle life, and apparently having a long life before him of usefulness and enjoyment, was, within ten hours after the application to the lip of strong potash and chloride of zinc by one of these harpies, dead from the absorption of this corrosive poison. The first two cases mentioned were brought to a successful issue in the courts; the judge holding, that if a person publicly practising as a physician, on being called to a sick person, prescribes with foolhardy presumption a course of treatment which causes death, proper medical assistance being at the time procurable, he may be found guilty of manslaughter, although he acted with the patient's consent, and with no ill intent. There is no more important legislation than the regulation of the practice of medicine; and it is to be hoped that the medico-legal societies or some other organizations will prepare laws which will drive from the country the thousands of impostors who are to-day living and growing rich upon the credulity and ignorance of the people.

AMERICAN ARCHEOLOGISTS might conveniently be divided into two classes, — those who dig, and those who do not dig. The diggers seldom get beyond the range of articles which they or some one else has dug up: the non-diggers rely chiefly on the chroniclers or contemporaneous historians for their facts. It is seldom that we meet with a man, who, like Mr. Maudslay, combines the best features of the two schools. At a recent meeting of the Royal geographical society, he gave an interesting account of his exploration of the ruins and site of the old Indian pueblo of Copan. This place was apparently unknown to Cortes, who passed near it in his celebrated march to Honduras. Our author argues from this that it was uninhabited at the time, — a deduction that does not seem to us altogether safe. At all events, the place is not mentioned by any early writer, and the first account we have of it is in a letter from the licentiate Diego de Palacio, an officer of the Audiencia of Guatemala in the year 1576. Copan, in the usual sense of the word as applied to the village which has been built amidst the ancient ruins, is situated just within the western boundary of the republic of Honduras, on the right bank of the Copan River. Mr. Maudslay went to work in a truly methodical and scientific way, and the results of his research are in some respects remarkable.

ALTHOUGH PROFESSOR FROTHINGHAM has left Baltimore to accept a chair at Princeton, the Johns Hopkins university is not to be without an instructor in archeology this winter. Prof. Rodolfo Lanciani is announced to give a course of six or more lectures during the current academic year, probably in January next, on Roman archeology. Professor Lanciani, though still a young man, has made a wide reputation for himself, and is one of the very first authorities on Roman archeology. He has been for some years inspector of excavations at Rome, and professor of archeology at the university there. He is a leading member of the Roman archeological commission and of the Pontifical archeological society. He has followed with great care the very important excavations that have, since 1871, laid bare so large a portion of the ancient Latin capital. In 1880 he published "I comentarii di Frontino intorno le acque e gli aquedotti, sylloge epigrafica aquaria," — a work which was crowned by the Academy of the Lincei. This book forms but a part of Professor Lanciani's great critical and historical work on the topography of ancient Rome, on which he has been at work for a long time.

A CASE OF GREAT INTEREST and importance has just been decided in Brooklyn against the municipal authorities. In 1881 the legislature of the state passed what is known as the 'plumbing law,' by which the plumbing and drainage of all new buildings were required to be done under the direction of the board of health. For the guidance and instruction of the plumbers, rules and regulations were established governing the construction of the works referred to in the law. Some of the plumbers violated these rules in various ways, among others by putting in iron pipe of a less thickness than was permitted. Although such a

violation was made a misdemeanor, it was found that houses might be constructed with serious defects; and, before any legal measures could be taken, the houses would be occupied, and the health of the occupants imperilled. In order to assist the health department in the enforcement of the law, the city works commissioner passed a rule that Ridgewood water should not be furnished to any new house until the plumbing-work was completed in accordance with the sanitary rules. For five years this rule has been enforced, and has been of great aid to the health officials in their endeavors to have houses properly sewered. Recently a row of houses has been constructed in which the soil-pipes were of light iron, in violation of the law; and, as the health department would not accept the work, no water could be obtained. On an application for a mandamus to compel the city to furnish water, one of the judges of the supreme court granted it, although the soil-pipes are of such weight as not to comply with the regulations. He holds that the city must grant permission to introduce water entirely irrespective of the regulations of the health department, and that, if any of these are violated, there is a remedy provided by the law. The result of this decision will be to embarrass the health department, temporarily at least, although ultimately it will doubtless find some way of speedily punishing offenders against the law.

IT SEEMS THAT the 'bogus butter issue,' as the politicians call it, is not confined to the United States. A similar agitation to that recently witnessed here is taking place in India; and a bill dealing with the adulteration of *ghee*, or clarified butter, hurriedly drawn and introduced in response to the urgent demands of the native community, has recently been passed by the Bengal council. The scope of the measure is very broad; and it applies, not to Calcutta only, but to all municipalities in the province. The result will be, it is hoped, the subsidence of the panic which has prevailed for several months. The reason for the panic is apparent, for *ghee* enters into the composition of every kind of cooked food used by all classes of the natives, and its adulteration with beef or pork fat meant loss of caste to Hindoos, and defilement to Mohammedans. So great has the panic been, that the wealthier natives have been importing *ghee* from Persia, while those unable to afford that have been abstaining altogether from cooked food. The subject has attracted such general attention, that it will probably be dealt with as part of a general act, applicable to all India, to prevent the adulteration of food.

THE PRESENT CONDITION OF THE COAST SURVEY.

THE administration of President Cleveland presents no greater enigma than the contrast between the high standard of public fidelity which its head has infused into most branches of the public service, and the unending succession of personal quarrels, charges, and counter-charges which he has allowed to discredit the administration of the coast survey, and impair its character and efficiency. The present condition of that work is such as almost to make us forget that there was a time, and that within the memory of every reader, when it was the model branch of the civil service, enjoying a world-wide reputation for the perfection of its organization, the standard of its work, and the character of its assistants, and cited by the advocates of reform as an example of what the civil service might become under an improved system of appointment to and tenure of office. One wanting to know on what system a scientific bureau ought to be administered cannot do better than study Bache's administration of the coast survey, and note how he combined the greatest liberality with the most scrupulous regard to the forms of law, the responsibilities of a public officer, and the requirements of a disciplined service.

Fifteen months have now elapsed since this dream of perfection was suddenly interrupted by the alleged discovery of grave irregularities and the forced resignation of a superintendent. Men were not unprepared for the latter result. It had become widely known that physical and mental infirmity, intervening at the end of a long and honorable career in the public service, had incapacitated the superintendent for the proper execution of his office; but wise and thinking men reserved their judgment when they were assured through the public prints that general corruption had eaten into the vitals of the organization, and that the work made famous by Bache had become a nest for peculators of the public funds.

The first act of the administration after learning of the seemingly demoralized condition of the survey was the appointment as superintendent, of the man on whose report of irregularities that office had been made vacant. For such an appoint-

ment there could be but one apology. The President and his secretary of the treasury were responsible to the public for the conduct of the survey; and it was their duty to take every measure for discovering any irregularities which might exist in its administration. A searching inquiry into the past disbursements of the officers and employees was eminently proper under the existing circumstances. Mr. Thorn, as head of the investigating commission, was well qualified for the inquiry; and we may charitably suppose it was on this account, and this alone, that he was made superintendent. Such being the case, the course prescribed by every principle of public justice and governmental policy was quite clear. An old and reputable branch of the public service was on trial before the President, for grave shortcomings in the conduct and character of its employees. Sound policy required that it and they should be conceded that same right to a speedy trial and a public verdict which an individual enjoys when accused of crime. For more than a year a body of men of high professional attainments and unstained reputation have felt themselves wounded by imputations on the service to which they belong, of which they once were proud, and of which they sometimes hope to be proud in the future. After waiting so long, they cannot but feel it a public wrong that the head of the government takes no measures and announces no conclusions which will indicate his verdict upon their official characters.

In this connection let us think kindly of Mr. Thorn. No one questions the honesty of his intentions or the purity of his motives. Circumstances not of his own making imposed upon him a disagreeable duty, in the performance of which he has spent more than a year. He has done as well as possibly could be expected of a man without administrative experience, placed in charge of a great public work in the capacity of prosecuting attorney. Gradually compelled by the force of circumstances to conduct the office in accordance with long-established custom, and to trust the men whom his predecessors have trusted, he now sees the very accusers of former administrations, who put him into power, turning against him, and even going so far as to file charges of malfeasance in office with the public prosecutor of the District of Columbia.

In the Washington *Post* of Monday last we find a statement by him so conclusive of the whole question, that we should doubt its authenticity did it not bear every mark of being given in his own words. At the conclusion of a long reply to the charges we have mentioned, he alludes as follows to the testimony of last year, on which the survey was condemned, and Mr. Hilgard compelled to resign: —

"The testimony, which the present proceeding is said to be intended to revive, has been out of my custody and in that of the department much more than a year. It is mainly *ex parte* affidavits, some true, some false, some mistaken, some since retracted, and more or less wild gossip since disproved. The publication of such material against people who were not confronted with the witnesses, and did not cross-examine them nor appear by counsel, and the spreading of it before the public, who can know nothing of the credibility or motives of any of the witnesses, or of the probable value of their testimony, would be simply an indiscriminate assassination of character."

Such an admission is most creditable to him, and must gratify every lover of purity in the public service. It must require a rare endowment of moral courage and respect for truth and justice to move one to speak thus of testimony which was collected by himself, and which formed the only basis for his appointment to one of the most important offices in the gift of the President. If we accept Mr. Thorn's statement, we shall see why the present condition of the survey tends to demoralization. It is a public establishment, in the prosecution of which the *esprit de corps* of its members is as important a factor as it is in the army or the navy. But the revival of the old pride in the service is impossible under the conditions which now prevail. The survey is in danger of losing the services of its best men, whose incentive to work is not salary, but professional pride in the honorable character and public utility of the work they are doing. That vacancies can be filled by men of equal promise under the conditions which now prevail, no one acquainted with the case can for a moment suppose. There will, of course, be a crowd of applicants for every vacancy, but the number really fitted for the places will be small, and will be sure to be passed over by any one but an expert in the selection of men for such a service. A year or two more such as the last will leave nothing worth preserving of an organization which was once the pride of American applied science, and a connection with which was a letter of introduction to similar organizations the world over.

SORGHUM SUGAR.

EXPERIMENTS are being carried on at Fort Scott, Kan., this fall, under the direction of the U. S. department of agriculture, in the application of the diffusion process for the extraction of the sugar from sorghum cane. This is a continuation of the work at Ottawa, Kan., last year, the results of which are embodied in Bulletin No. 7, chemical division, department of agriculture. At Ottawa experiments were made in connection with a sugar-factory, which employed a mill to work up most of their crop. This year the Parkinson sugar company of Fort Scott, relying upon the results obtained there, erected no crushing machinery whatever, depending entirely upon the diffusion battery to extract the sugar from their cane-crop of over eight hundred acres.

The crop this year showed the remarkable power of resistance to drought of the sorghum-plant, the patches of which constituted about the only oases of green in an otherwise dry and withered-up vegetation.

The factory has been in operation since about the 1st of September; and while the results do not, perhaps, fulfil the anticipations of the more ardent advocates of diffusion, still they are in many respects most satisfactory, and full of promise for the future success of the sugar industry.

It is turning out a very fine article of sugar, in large quantities, fully as good as to crystallization, color, and taste, as any made by mill extraction; while the analysis of the exhausted chips shows an almost complete extraction of all the sugar content of the cane, — something which is impossible to obtain by pressure extraction, however thoroughly applied.

The principal difficulties which were encountered have been, first, the proper chipping of the cane, or preparing it for diffusion; and, second, the treatment of the juice obtained. These are both points in which the previous applications of diffusion, viz., on beets, offered but little guidance, the nature of the substance used being so very dissimilar. The sorghum cane is fed directly to the cutters, with the leaves and sheaths still on (it is too expensive to strip it); and while these are partially taken out afterwards by means of blowers and fans, still a large percentage find their way into the cells with the chips of cane, and from these a great many colloid matters are extracted by the juice which interfere materially with its proper clarification and the crystallization of the sugar. The solution of this difficulty will undoubtedly be found in a more perfect mechanical cleaning of the chips, or by the invention of machinery by which the stripping of the cane can be accomplished more cheaply than by hand-labor.

The problem of the proper treatment of the juice calls for the greatest amount of chemical ingenuity and invention. The juice obtained by diffusion is much more impure and difficult to treat than that obtained by a mill, partly on account of the presence of the leaves, etc., as already mentioned, and partly because the tissue of the cane does not seem to be as good a medium for osmosis as that of the beet.

The process sought to be applied to this juice at Fort Scott is that of carbonatation as used upon beet-juice. The details of this process are well known to those versed in sugar methods: milk of lime is added in large excess to the juice, and is then precipitated as carbonate by treating with carbonic-acid gas. The glucose, however, which is a constant constituent of sorghum juice, and of which the beet contains no trace, unites with the lime to form a dark-colored, bitter-tasting compound, which no amount of carbonating can break up. This difficulty has been to a large extent surmounted by performing the carbonatation at a low temperature, and heating only after the excess of lime has been entirely neutralized by the carbonic-acid gas. A novel modification of this process has also been attempted by adding freshly precipitated carbonate of lime directly to the juice, heating, and sending directly to the filter-presses, thus avoiding the direct contact of the juice with caustic lime. The indications from the present results are most hopeful, — that, with the expenditure of a small fraction of the money and brains that have been required to develop the sugar of the beet, the sorghum-sugar industry will take a leading place among American industries, and enable Uncle Sam to accomplish a long-cherished hope, viz., of making his own sweets.

It is the intention of the department of agriculture, at the conclusion of the sorghum season, to make some trials of the Kansas machinery upon Louisiana cane, getting it in by rail, pending the trial of next year, when it is expected to erect a diffusion plant in that state. With the proper co-operation of the railroads and of the southern planters, this can undoubtedly be carried out; and the results will be most valuable. The sugar-planters of Louisiana have been watching with the keenest interest the experiments in Kansas, several of their representative men being on the ground. They reason that its success upon sorghum cane will augur its success upon their own plant, many of the difficulties attendant upon its application to the former not holding good with respect to the latter.

LONDON LETTER.

THE series of congresses, more or less scientific in character, which in England claim a share of attention from men of science, who devote some of their hardly earned vacation to them, may be considered to have closed with the Sanitary congress at York. Sir Spencer Wells presided over it, and in his opening address observed that the main question now to be considered is, how sanitary improvements may be carried still further by the co-operation of investigators, legislators, and administrators. For this purpose he suggested the formation of a college of health, to organize a well-directed attack against existing obstacles. Much, however, had been done: in the last fifty years, for example, the average duration of life in Great Britain had been raised from thirty to forty-nine years. Of the various subjects discussed at the congress, probably the disposal of the dead was the one which excited the greatest interest. There appeared to be decided evidence that the feeling in favor of cremation was on the increase; and the opinion of the representative clergy present was to the effect that they were waiting for a decisive word from the scientific men upon the matter, by whom they were willing to be guided.

The return to England of the Solar eclipse expedition on Sept. 20 was speedily followed by a letter from the *Times* correspondent who accompanied it, in which the chief results obtained were discussed in preliminary fashion. Most of this letter is reproduced in *Nature* for Sept. 23. The new facts obtained were chiefly due to the work of Professor Tacchini, who satisfied himself that there was a great distinction between the eclipse prominences and those seen by the ordinary method. Both he and Mr. Lockyer consider that the former are due to down-rushes of comparatively cool material upon the sun's surface, and that they form a whitish fringe round the more incandescent centre. This, if well established, has a very important bearing on the theory of solar physics. Captain Darwin's work appeared to demolish entirely the idea entertained by Dr. Huggins and others, that the solar corona could be and had been photographed at times other than those of eclipses.

The opening of the medical schools in connection with the metropolitan hospitals, at the beginning of October, is always signalized by the delivery of some thoughtful introductory addresses by prominent members of the staff. One of the most remarkable of these was delivered at St. Mary's hospital by Dr. Malcolm Morris, and dealt with mysticism, scepticism, and materialism in medicine. He thought that the element of mysticism in medicine had been forced on it by the public. It was the result of two opposing conditions, — the absolute knowledge demanded by the laity, on the one hand; and the more or less extensive ignorance of the professor of the healing art, on the other. This ignorance, where it existed, he must not acknowledge: he was expected to be able to recognize disease, and to know how to treat it. Despite recent strides, medicine was still extremely defective. The absolute knowledge insisted on by the public could not be obtained, and therefore had to be invented. Scepticism in medicine was neither more nor less than modern fatalism. The tendency of the present day was to devote attention to the part rather than the whole, and it was too commonly supposed that truth lay at the bottom of the microscope. At King's college, Dr. G. Johnson, F.R.S., urged at some length the value of the study of chemistry as a mental training and discipline, and then proceeded to point out that the only safe foundation for specialism was a thorough knowledge of disease in general; and this he illustrated by reference to diseases of the eye and of the larynx. The principal of the Royal veterinary college pointed out that in both human and veterinary medicine the elaboration of the germ theory of Pasteur, in its earlier triumphs in the department of surgery, was likely to be surpassed by what might reasonably be expected would yet be achieved in the domain of medicine.

True to the exceptional character of the year in matters of temperature, October has set in unusually hot, 78° being recorded in the shade in London on Oct. 1. Such an October temperature has only once been exceeded during the maintenance of existing records. W.

London, Oct. 3.

NOTES AND NEWS.

CAPTAIN BAKER, British steamship Red Sea, Liverpool to New Orleans, reports to the U. S. hydrographic office that on Sept. 19, when some miles north of the Azores (exact position not given), he experienced what he considers an earthquake shock, on account of its suddenness, force, and after-effects. The first warning of a meteorological change was noticed in the dropping of the barometer for a tenth or more, and the freshening of the breeze, though veering. This was suddenly followed by a shock, sudden and powerful, causing the vessel to be thrown on her beam ends. She quickly righted, and was headed on just in time to meet the immense sea which suddenly rushed towards the port bow. She rode it gallantly, throwing her propellor far out of the

water, shaking the coal on deck (for the donkey-engine) all over, and causing the boats to strain their davits severely. No damage was sustained, but the captain doubts if any heavily laden vessel could have ridden the sea as his vessel did, she being in ballast only.

— *Nature* states that advices from the waters of Spitzbergen now confirm the former news from Iceland and from the mouth of the Pechora, on the Siberian coast, to the effect that the ice in the Arctic Sea has this year extended unusually far southwards. Spitzbergen, the sealers report, was found to be surrounded with an ice-belt from five to eight miles broad, and there was firm pack-ice from Hope Island to Forland, about fifty-six miles. The great bays on the Storfjord, Hornsund, Bellsund, and Isfjord, were quite inaccessible; and the sealers, after waiting all the spring and most of the summer, returned at the end of August, as there was no prospect of the polar ice dividing.

— Mr. H. B. Gibson of Harvard college presents in the *American meteorological journal* the results of a study of the water-spouts on or near the Gulf Stream, recorded on the monthly pilot-charts of the hydrographic office. He shows that they are here by no means so rare in winter as observations from other parts of the ocean have led writers to suppose; and, on comparing the dates of their occurrence with the corresponding signal-service weather-maps, it appears that they coincide with the extension of cold north-west winds, or 'cold waves,' from the land out over the relatively warm sea. A similarly exceptional winter frequency of spouts might be looked for on the warm Kuro Siwo, east of Asia.

— The need of a neat and comprehensive record-book for meteorological observations has been supplied by Sergeant O. N. Oswell, of the signal service (now at Cambridge, Mass.), who has prepared a blank volume giving appropriate pages, columns, and daily lines for temperature, pressure, precipitation, humidity, wind, weather, and remarks, followed by a page for the monthly summary. Its use would save much time to the many volunteer observers who have to rule their columns to suit their needs.

— A statement to the effect that glass railway rails were being manufactured in Germany, which has been going the 'rounds of the press,' was based, it is discovered, upon the mistake of a translator, who should have written 'sleeper' instead of 'rail.' Samples of these glass sleepers for railway rails, recently tested in Glasgow, resisted a weight of four hundred pounds falling nine feet and a half, not breaking until the sixth blow. Cast-iron sleepers are expected to stand a similar test up to seven feet only.

— A report on the Charleston earthquake, by Prof. T. C. Mendenhall, at that time an assistant in the U. S. signal service, states that the origin of the disturbances appears to have been somewhere below a point fifteen or twenty miles north-west of Charleston; that is, in the neighborhood of the town of Summerville. A chart of provisional coseismal lines, drawn by Mr. Hayden of the geological survey, and published in *Science* for Sept. 10, seems to locate this centre somewhat farther north than the point indicated above. At the time of its construction, however, information from many points was lacking, and that which was at hand was admittedly doubtful in some degree.

— The *British medical journal* reports the case of a workman who fell a distance of 110 feet from the steeple of a church. In his fall he broke a scaffold, and, after passing through the roof of an engine-house, broke several planks and two strong joists, finally falling upon some sacks of cement. As a consequence of this fall, one leg was broken, several small bones about the wrist were dislocated, and the back and hips were bruised, notwithstanding all of which the man left the hospital where he was taken for treatment in twelve days, with his broken leg in a splint of plaster-of-Paris.

— *El thifaa* ('the cure') is the name of the only medical journal published in Egypt. It is printed in Arabic, and published monthly. Its price is thirty-five cents a number. The principal contributors are Egyptians and Syrians. It has proved in every way a success.

— The St. Petersburg *Novoe vremya* of Oct. 1 contains an article on the Afghan frontier question, exhibiting surprise at the recall of the British commission, expressing the opinion of the possibility of further misunderstandings as to the north-eastern frontier at the foot of the Pamir range, which section is insufficiently explained by the agreement of 1873, and dwelling on the necessity of defining the frontier on the middle and upper Oxus, where Afghanistan borders on Bokhara. The Afghan frontier commission reached Haibak, 190 miles from Khamiab, on the 26th of September, and halted for a few days to explore the Hindoo Koosh passes. It probably reached Cabul on Oct. 14.

— That cholera has obtained a strong hold in Europe is becoming daily more apparent. The disease still exists in Pesth, and it is reported that at Szegedin, Hungary, seven persons died within twenty-four hours. The Austrian state director

of railways returned to Vienna from Pesth last week, and died from cholera on the 17th.

— The fever which existed some months ago at Biloxi, Miss., a seacoast town eighty miles east of New Orleans, on the Louisiana and Nashville road, and which was pronounced to be yellow-fever by the Louisiana state board of health, has again broken out in epidemic form, there having been three hundred cases with eighteen deaths. Great excitement exists in New Orleans and its vicinity, and the most rigid quarantine has been instituted against the entire county in which Biloxi is situated.

— The first person upon whom the title of doctor in medicine was ever conferred was William Gordenia. The college at Asti gave the degree in the year 1329.

— During the past year two new methods of treating hay-fever and other forms of nasal catarrh have come into use. The one is the use of the galvano-cautery for destroying the mucous membrane of the nose ; and the other, the employment of hydrochlorate of cocaine, either in the form of spray or as a suppository or tablet. The testimony of the physicians and the sufferers from hay-fever who took part in the thirteenth annual meeting of the Hay-fever association in Bethlehem, N.H., was to the effect that cocaine gives but temporary relief. Some reported that they were completely cured after treatment with the galvano-cautery ; others, that they were much relieved ; but the larger number of those who had been thus treated had found no relief whatever.

— Dr. William H. Dudley, president of the collegiate department of the Long Island college hospital, Brooklyn, died in his seventy-sixth year, on the 8th of October, from hemorrhage of the lungs. He was one of the founders of the hospital, and lived to see it take a place in the front rank of American medical colleges.

— The Brookville society of natural history has recently been provided with very commodious rooms in a new business block. These rooms are now being fitted up for its use, and will be occupied by Nov. 1. Dr. D. G. Brinton of Media, Penn., delivered the first of the lectures in the course given by the society, on the evening of Oct. 15, upon 'The study of man.' This will be the fifth course of free lectures which this society has given.

— Mr. G. A. Smith, the private secretary of Mr. Edmund Gurney, the indefatigable secretary of the Society for psychical research, is shortly to visit this country, and while here will hunt up a good many of the persons who have furnished accounts to the society. Mr. Gurney's book, 'Phantasms of the living,' will appear shortly. It will be recalled that it was announced in the spring ; but a large fire destroyed almost the entire edition, and from correcting the proof on, the whole process of book-making had to be gone through with a second time.

— The Afghan frontier commission is now expected in India. Colonel Lockhart's mission found that Manchester cotton goods had complete command of the market in Ghilgit, Chitral, and even Wakhan, and sold at an average price of one rupee for five yards. Russian cotton seemed unknown, and what was not obtained from English sources was supplied locally or from Chinese Kashgar. They also found that American fire-arms were imported *via* Russian Turkestan, underselling English weapons from India. A good revolver from Cincinnati was purchased in Chitral for fifteen rupees.

— Mr. George Muirhead, says *The athenaeum*, has for some years been studying the birds of Berwickshire, and is about to publish his researches. He has paid special attention to the hawks, the dotterel, the bittern, and other birds, many of which are rapidly lessening in numbers. Provincial bird-names and folk-lore will not be forgotten, and a special chapter will be devoted to falconry. The book will be illustrated by etchings, and Mr. Douglas of Edinburgh will publish it.

— It is gratifying to find that lithology is being rescued from the status of a merely 'practical study,' in the curriculum of the American college, and is becoming established as an exact science. The monograph ('Modern petrography,' by G. H. Williams, Boston, *Heath*, 1886) of Professor Williams on that subject supplies the student with a compact yet full history of the steps taken to elevate it from the domain of conjecture to that of fact, and to change the microscope from a toy to a valued assistant. While not giving to our home institutions as full credit for regular instruction, in the past, as the facts warrant, the monograph is interesting as showing that a desire for the more exact methods of rock-analysis is becoming prevalent among American students, and that it will not be necessary to go to the continent for needful instruction. The appended note on forming rock-sections, and the cost of obtaining them from trustworthy parties, will be of value to the beginner, as will be the bibliography of the science.

— The 'Theory of magnetic measurements,' by F. E. Nipher (New York, *Van Nostrand*, 1886),

will be found a very convenient book of reference by those who have already had some acquaintance with the methods of determining the constants of terrestrial magnetism, and who desire to refresh their memories upon any of the more important principles of the theory and practice of the instruments ordinarily used in magnetic surveys. Such persons will find especially convenient the forms given for recording and reducing observations made with the various instruments. Some trouble would be saved, however, if the explanations of the quantities set down in each column were brought into a closer connection with the columns themselves. To those unacquainted with the subject the book will often seem wanting in clearness, — a fault which appears in many cases to be the result of too great an effort at condensation. A few pages are devoted to the method of least squares, and tables are given to assist in determining the meridian from observations on the elongation of Polaris. Opinions will differ as to the advisability of inserting so much of a general discussion on the relations between systems of units in order to derive the ratio of the 'foot-grain' to the C. G. S. value of the horizontal intensity.

— Mr. A. Lawrence Rotch, of the Blue Hill meteorological observatory, has issued reprints of several articles in the *American meteorological journal*, with additional heliotype illustrations, on the 'Mountain meteorological stations of Europe,' which he visited in the summer of 1885. The establishment, outfit, publications, and results of seven stations are described in much detail. Their names, altitudes, and dates of establishment are as follows: the Brocken, Germany, 1,141 metres; Schneekoppe, Germany, 1,599 metres, 1880; Wendelstein, Bavaria, 1,837 metres, 1883; Hoch Obir, Austria, 2,148 metres, 1878; Sentis, Switzerland, 2,504 metres, 1882; Puy de Dôme, France, 1,463 metres, 1876; Pic du Midi, France, 2,877 metres, 1880; Ben Nevis, Scotland, 4,407 feet, 1883. It may be added that Mount Washington was the first, and Pike's Peak is still the highest, mountain meteorological station in the world.

— The Appalachian mountain club has lately published a copy of the contour-line map of Williamstown and Greylock, as executed by Messrs. Johnson and Natter, topographers of the U. S. geological survey, in the joint topographic undertaking with Massachusetts. The reproduction is on the scale of the original plane-table sheets, 1: 30,000, and therefore covers an area fourfold that which will be allowed on the publication of the map. The district is in the northwestern corner of the state, and is well chosen for illustration of the progress and value of the survey, as it includes the highest and probably the roughest piece of ground in the commonwealth. The 'hopper' on the western slope of Greylock, and the rugged ridges on the eastern slope, are very well expressed by the contours, although the photolithographic reproduction is not so delicate as could be desired. The cost of the sheet is, however, very moderate, — thirty cents; for sale by Clarke & Carruth, Boston.

— The August number of the *Alpine journal* contains a statement of the results obtained by Dr. Marcet from many experiments on breathing while climbing at high altitudes. He first shows by experiments at ordinary altitudes and in a state of rest that some persons make much better use than others of the air they inhale, inasmuch as their exhalation is very rich in carbonic acid: this may be expressed by measuring the volume (at sea-level pressure and freezing temperature) of air inhaled to produce one gram weight of carbonic acid. Dr. Marcet himself had to breathe 15.5 litres of air, while two younger men needed only 13.7 and 10.8 litres respectively: the latter had a remarkable power of keeping his breath under water, and was little troubled in mountain ascents. Further experiments, conducted at various altitudes up to 13,600 feet, show, that, as a person ascends, he breathes fifteen to twenty-five per cent less air (reduced, as above, to standard pressure and temperature) to produce a given weight of carbonic acid: the action of air on the blood in the lungs seems, therefore, to be facilitated with decreasing density. It is evident that this will materially diminish the quickness of breathing that would otherwise be required in rarefied air.

— A meeting of the National association for supplying medical aid to the women of India was held at Simla on Sept. 29, Lady Dufferin presiding. The reports received from the various provinces were highly satisfactory, The main object now was to establish the association on a permanent footing; for which purpose further funds were required. The estimate for next year's work showed a surplus; but, before the financial condition of the undertaking could be called thoroughly satisfactory, it required a lakh and a quarter more capital. Sir C. Aitchison gave an account of the work done in the Punjab. He said that the province was not rich. The few wealthy men had given what they could, and the movement was spreading among other classes.

— A new laboratory-burner, devised by a Detroit inventor, appears to be both simple and efficient. The base of the burner is provided with a station-

ary needle-valve surrounded by a vertically adjustable jet-tube with a conical aperture controlled by the valve. Arms extending upward from the jet-tube support a vertically adjustable mixing-tube, constructed so as to close the upper end of the jet-tube when desired. The proportions of gas and air, as well as the size of flame, may be regulated by a simple rotation of the jet-tube upon the base.

— One result of recent experiments with oil for smoothing the surface of the sea during stormy weather is that inventors are turning their attention toward improving the methods of applying the oil. A device recently patented is a floating distributer, consisting of a case containing two compartments, one of which serves as a buoyant chamber, while the other is perforated, and receives and distributes the oil, which is supplied to the distributer through a supply-tube.

— It is proposed to form an association of the graduates of the Lawrence scientific school connected with Harvard university. There are numbered among these graduates many of the students of Agassiz.

— Messrs. B. Westermann & Co. announce the continuation of Carus and Engelmann's Bibliotheca zoologica. The first part of the continuation is expected immediately, and the whole will be completed in 1888. Carus's *Zoologischer anzeiger* has since 1878 recorded the publications on zoölogy. The new volume of the Bibliotheca zoologica is intended to fill the gap between the *Anzeiger* and Carus and Engelmann's Bibliotheca zoologica, which covered the literature of 1846–60.

— Several cases of hydrophobia have recently occurred among camels in Algeria. As the animals had never been bitten, the origin of the disease was unaccountable, until it was ascertained that a mad horse had gained admittance to the pasture; and the explanation given by those who studied the case is, that his saliva had fallen on the grass, and the camels had become infected through abrasions in the mouth.

— A healthy boy has just been born to an aged couple of St. Joseph, Mo., the father being seventy-one and the mother sixty-five years of age.

— Dr. Williams, in the *St. Louis medical and surgical journal*, relates an interesting case of temporary blindness from the excessive use of tobacco. The patient was a blacksmith, thirty-two years of age, who complained of failure of vision to such an extent that he could no longer see to drive nails in shoeing, and was compelled to depend on his sense of feeling. His health was good, he having no other complaint. Vision was found to be only one-sixth of what it should be. Things appeared to him to be covered with a dense mist. For many years he had been an excessive smoker, using the strongest tobacco to be had. Tobacco amaurosis is quite common, but usually in men beyond middle life. The probability of recovery is great if the habit is given up, and this should be done gradually. In this case, a very few days' abstinence from tobacco caused an improvement in vision, and the man has now made material progress toward recovery. Dr. Williams does not regard chewing tobacco as so likely to produce this defective vision as the habit of smoking.

— Pasteur, in a letter to Dr. Davis of Philadelphia, gives the following *résumé* of his experience in inoculation for the prevention of hydrophobia from the beginning up to Sept. 1 of the present year: —

COUNTRIES SENDING PATIENTS.	TREATED.	DIED.	REMARKS.
France and Algeria	1,324	4	Too late for treatment.
England	68	1	
Austro-Hungary	43	0	
Germany	9	0	
United States	18	0	
Brazil	2	0	Average failure is 1 for 150 foreign persons treated, and 1 for 330 French and Algerians.
Belgium	50	0	
Spain	75	2	
Greece	10	0	
Portugal	24	0	
Holland	14	1	
Italy	138	0	
Russia	186	12	8 by wolves, and 4 by dogs.
Roumania	20	2	
Switzerland	2	0	
Turkey	2	0	
Bombay	1	0	
Total	1,986	22	6 too late for treatment.

— After a long discussion, according to the *Chemical news*, the Belgian academy of medicine rejected the two following propositions, which had been submitted by Dr. DuMoulin: viz., "Copper combined with articles of food in the proportions usually met with is not dangerous;" "Especially the greening of preserved vegetables with copper salts is absolutely inoffensive." The academy, on the contrary, adopted the following proposition, which will be transmitted to the government: "The compounds of copper are not merely useless in foods; they are injurious."

— Kite-flying, from a scientific point of view, has received considerable attention in France. As the result of a series of experiments with a gigantic kite, it has been determined that the best results in ascensional power and height of flight are obtained when the string is attached to the kite at a point above the centre of pressure, in a line drawn from the centre of pressure to the centre of gravity, in such a manner that the distance

from the centre of gravity to the point of attachment of the string shall be three times the distance between that point and the centre of pressure.

— A recently completed iron water-tower, 250 feet high at Sheepshead Bay, near Coney Island, while being tested a few days ago, gave way at the base, and fell, shattered, to the ground when the water reached a height of 227 feet.

— The meeting of the Public health association was closed at Toronto recently. Dr. George M. Sternberg was elected president, Prof. Charles N. Hewitt first vice-president, Prof. C. A. Lindsley second vice-president, and Dr. Irving A. Watson secretary, for the coming year.

— Pretty much the whole of the September number of the *Journal of the Society for psychical research* is devoted to an interesting tale of a 'haunted house.'

— Arrangements are being made at Newcastle-upon-Tyne for holding there a mining, engineering, and industrial exhibition (international and colonial) in 1887, to mark the jubilee year of the reign of the queen.

— Dr. Schweinfurth has, says *Nature*, addressed to all Europeans, especially physicians, residing in Egypt, an inquiry as to whether, so far as they are aware, families of northern origin settling in Egypt do, or do not, die out within three generations, or whether the race is capable of being perpetuated beyond that limit.

— It is stated by the London *Engineering* that a dirigible balloon of colossal dimensions has been for some time in course of construction in Berlin. It is 500 feet in length, 50 feet in diameter, and weighs 43,000 pounds. The propelling power consists of two steam-engines of 50 horse-power each.

— In a recently patented soda-motor, intended for use on street-railways, the process of generating steam is as follows: the caustic soda, which is contained in a reservoir surrounding the steam-boiler, is raised to a high initial temperature by means of jets of burning gas or petroleum, thus evaporating all moisture from the soda. The heat from the soda produces steam in the boiler, which is applied to an ordinary engine; the exhaust steam from the engine is then absorbed by the soda, producing heat sufficient to generate steam, until the soda is supercharged with moisture, when the jets of flame, which in the mean time have been dispensed with, are again ignited to regenerate and reheat the soda. The operation may be repeated continuously. This is a modification of the soda-motors which have been in use several years past in this country and in Europe.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

How astronomers may work.

IN your issue of Oct. 15, I notice the reply of Professor Holden to your comment on his scheme of inviting the leading astronomers of the world to visit Mount Hamilton, one at a time, to use the Lick telescope when not in use by the regular observers. I think Professor Holden is unfortunate in his selection of examples of good work done at high elevations. Each one of his examples might be quoted as an instance where excellent results were gained as the reward of *continuous* work by a skilled observer, using the instrument with which he was most familiar, and in a field of research where his powers of observation were at their best. Probably we should know less than we now know about radiant energy, if Mr. Burnham had gone to Mount Whitney to use the bolometer, in place of Professor Langley and Mr. Keeler. And we may be quite certain Professor Langley would not have added to his reputation, had he gone to Mount Hamilton to use Mr. Burnham's telescope, searching for double stars. Doubtless, many men will be glad to have an opportunity to look through the Lick telescope, to note how familiar objects appear when seen with an instrument of its anticipated perfection and power. But it does not seem possible that any results of scientific value can be obtained from such scrappy, disjointed work as is proposed by Professor Holden. T.

New York, Oct. 19.

Larval amblystomas for laboratory work.

During the past summer I have sent to the Smithsonian institution several hundred living specimens of larval and adult amblystomas. These were to meet the demand for these important forms on the part of special workers, and the biological laboratories both in this country and Europe, a number of them having been sent to M. Chauvin in Germany.

Quite recently, however, I have received a number of other applications from colleges and other points, requesting a few specimens of these animals for their investigations, and for the use of biological students. To meet these latter demands, I send by express to-day an unusually fine lot of some two hundred and fifty living larval amblystomas, and two adults, to Professor Baird, at the Smithsonian institution, Washington, D.C., where, if proper application be made for them, I am assured they will be sent to any point in accordance with the regulations governing the distribution of such material from that institution. R. W. SHUFELDT.

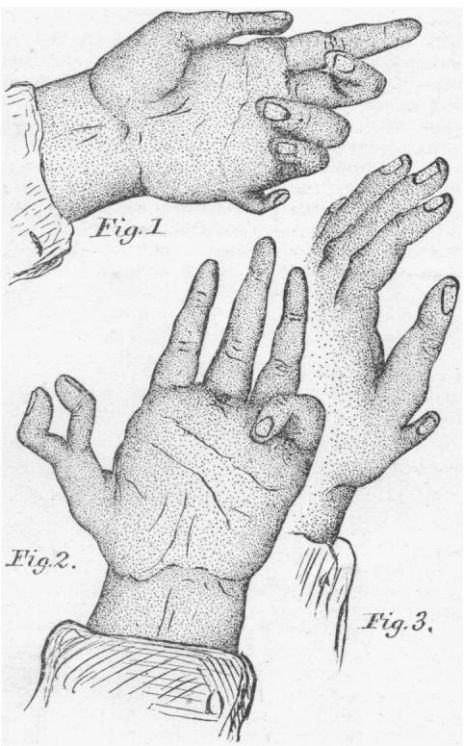
Fort Wingate, N. Mex., Oct. 8.

Polydactylism.

An instructive example of this abnormity was under my observation at about the time Dr. Le Conte published his interesting letter upon the subject (*Science*, Aug. 20), and Mr. John B. Smith of the U.S. national museum, in a subsequent number, added his own observations (*Science*, Sept. 3) in regard to it.

The case I refer to is that of a man (F. G.) living

near Fort Wingate, N. Mex. He is about thirty-five years of age, and comes from a Mormon family, and is polydactylous upon both hands. His father's hands were normal; but his father's twin-brother had bud-like, nailless, supernumerary little fingers, without any bones in them. There are fourteen children in his father's family, seven of whom have normal hands, while the remaining seven have either a surplus number of fingers or toes. A sister older than himself had both extra little fingers and toes, but they had no bones in them: indeed, he is the only one of the children that possessed them in that degree of perfection. Two sisters younger than himself had supernumerary little fingers and toes, and two of his younger brothers had simply the boneless little fingers, while their feet were normal. There is no history of polydactylism on his mother's side, and he has no recollection of the condition prior to his father's twin-brother.



I carefully examined these additional little fingers in the man in question, and present with this letter, in fig. 1, the palmar aspect of his left hand, the member upon which it was best developed. It has two joints, the distal one being somewhat flexed upon the proximal one when the hand is at rest; but, as the finger is supplied by both a good flexor and extensor tendon, it can be readily moved independent of the normal digits. These tendons, as well as I could ascertain, were branch offshoots of the tendons of the flexor sublimis digitorum and the extensor minimi digiti respectively.

The proximal head of the first phalanx articulates with an extra metacarpal head, which branches from the metacarpal bone of the little finger proper, to the outer side of its own distal head, and rather on the external aspect of the side of the shaft. No doubt the arterial supply of this extra little finger corresponds to the similar branches of the deep and superficial palmar arches, and an offshoot from the little-finger branch of the posterior carpal at the back of the hand, which go to the little finger proper.

A perfectly formed nail is found upon both of these supernumerary digits; though in some particulars the extra digit of the right hand is not as near like a normal finger as the one I have figured on the left, more especially in points of mobility and size.

Several years ago I saw a very remarkable case of polydactylism in a man of about forty-five years of age, an ignorant Irish farm-hand; and I could get nothing of the history of the inheritance of it from him. This man (P. M.) had, articulating with the distal head of the proximal phalanx of pollex, two small and supernumerary thumbs, which faced each other, as I have drawn them in fig. 2. Each of these had two joints and perfect nails, and was evidently supplied with special branch slips of tendons; as I have frequently seen the man use them as a kind of pair of forceps, and pick up, if he chose, his pipe with them. If I recollect rightly, both hands were similarly deformed. The only other record I have ever made of this case was in 1872, when I drew a rough sketch of it for Prof. Burt G. Wilder at Ithaca, who was at that time interested in such matters, and making a special collection of such data, and deformities of these members.

Supernumerary thumbs occur elsewhere on the hand, as in the case I have drawn in fig. 3. This was a boy schoolmate of mine (J. O. D.), now a prominent artist in New York, and it was early removed during childhood by amputation. If I remember correctly, his father's and mother's hands were perfect, and the deformity only occurred upon one of his own hands.

Among the vertebrates below man, we occasionally meet with cases of polydactylism, and in all vertebrates, as we know, numbers of cases where we find duplicature of entire limbs.

R. W. SHUFELDT.

Fort Wingate, N. Mex., Oct. 7.

Psychology of the bear.

In *Science* for Aug. 27 is an interesting letter from James P. Marsh upon the psychology of the polar bear. The following item, bearing upon the same subject, is going the rounds of the press, and may be of interest to those familiar with the ways of animals in general, and bears in particular: A bear had been having a merry time among the sheep of the farmers of Clarendon, New Brunswick, during the summer. All attempts to catch the beast failed. Last week a trap was set, and a fence erected so that he would have to step into the trap in order to get at the bait. Bruin surveyed the situation, and concluded, after some study, that he could get over better. He went to the rear of the enclosure, dug a deep hole under the trap, and then overturned it, thus securing the bait without any injury to himself. Not to be outwitted by a bear, the farmers tried again. The old trap was left where it was, and another placed where the bear got through before. The ruse worked like a charm. Bruin came along, snuffed at the bait, and, recollecting his previous success, determined to try the back entrance. He did not see the second trap,

and coolly put his foot into it. He was there next day, full of wrath, and a bullet put an end to his existence. H. J. T.

Millerite.

I wish to place on record the occurrence of the mineral millerite in the Keokuk beds of the subcarboniferous rock of Iowa. I have just received a few specimens of rock blasted out when the government was deepening the channel at the 'rapids' in the Mississippi, above Keokuk, some years ago. The specimens show cavities in the limestone, partially filled with calcite crystals, mostly of the scalenohedral form. In some instances these crystals carry very beautiful thread-like crystals of millerite. They are usually aggregated in the form of cones, the apices of which are almost solid on account of the threads being so close together, while at the bases of the cones they are much farther apart.

The occurrence seems to be in every way similar to the occurrence of the same mineral at St. Louis, Mo. A few small crystals of tetrahedral chalcopyrite are also present. ERASMUS HAWORTH.

Penn college, Oskaloosa, Jo., Oct. 9.

Alligators in the Bahamas.

Catesby, in his 'Natural history of Carolina, Florida, and the Bahama Islands,' published about a century ago, speaks of having seen alligators on the Island of Andros in this group. At present there are none, and, with the object of finding out if there was any tradition current bearing upon the subject, I made inquiries through the medium of the *Nassau guardian*. In answer to my questions, I lately received from the rector of Inagua, at the extreme south-east of the group, a letter, in which he mentions that stories of alligators having been drifted on logs of mahogany, and thrown up on the shores of the island, are common, but that he had not been able to verify any of them. However, a few days previous to the date of the letter, while on a visit to one of the settlements, Mr. de Glauville (the rector) was shown the skin of an alligator eight feet long from tip to tip, which had been shot on shore a day or two before by a man whose name is given. Many logs of mahogany had been cast up on the shores of Inagua about that time; but the alligator had not been observed to land, and had been seen on shore several times before it was shot.

There seems, however, to be no reasonable doubt that the alligator was drifted by the current from the south-east to Inagua, on a log of mahogany, from San Domingo, the nearest place in which alligators are found. This means that it travelled a distance of from one hundred to one hundred and fifty miles. With regard to the occurrence of alligators on Andros, Catesby was a very accurate observer, and there seems to be no reason for doubting his statement. These alligators would appear to have been carried on drift-wood from the north-west coast of Cuba, a distance of three hundred miles, by the Gulf Stream, and cast on the edge of the Great Bahama Bank, whence local currents, aided by the wind, might have carried them to the west coast of Andros. The absence of traditions on the subject may be owing to the fact that the present inhabitants of Andros are principally descendants of persons who settled there at a period subsequent to Catesby's visit.

These instances of the dispersion of large animals by means of oceanic currents may be of interest to those of your readers who study the question of the geographical distribution of animals.

While on the subject of Andros, may I be allowed to mention two rather curious superstitions current among the inhabitants of that interesting island? The interior of the northern part of the island consists of swamps and lakes, interspersed with patches of rocky ground on which the Bahama pine (P. bahamensis) grows thickly. The negroes have a great dislike to entering these pine-woods alone, or even in small companies; for they say that a peculiar race of malevolent beings, called 'little people,' inhabit the trees. These creatures are said to be like tiny men covered with hair. They sit on the pine-boughs, and if a man notices them, and points them out to his companions, the whole party is rendered immovable for a day and a night; but, if fire is thrown at the 'little people,' they disappear without doing any harm.

The other superstition also relates to the pine-woods. Creatures like enormous hairy men, called by the negroes 'Yayhoos,' are said to march about the woods in 'schools,' the largest coming first; and 'when dey cotch you, dey tear you.' These beings are naturally much more dreaded than the 'little people.' It looks as if their name had been given by some traveller familiar with 'Gulliver's travels,' and struck with the resemblance between them and the terrible creatures of Swift's imagination.

Both of these superstitions would appear to be traditions of the land from which the negroes originally came. The 'little people' are probably a recollection of the small, arboreal monkeys, while the 'Yayhoos' represent the gorillas, of West Africa.

JOHN GARDINER.

Nassau, Bahamas, Sept. 17.

Earthquake sounds.

In answer to your correspondent who asks, in the last number of *Science*, for some explanation of the sounds which often precede and accompany an earthquake shock, I would offer the following brief statement, condensed from Mallet's discussion of accompanying tremors and sounds (Report on Neapolitan earthquake of 1857, vol. ii.): Considering a rent or fissure to form in rock and rapidly enlarge, its formation is commenced and ended by tremors of very small amplitude, while the waves of amplitude great enough to produce the ordinary effects of an earthquake shock cannot be generated till after the focal cavity is enlarged to a certain amount. Waves of sound probably accompany the rending of the entire fissure: if the velocity of inceptive rending be sufficient, the sound waves set out the earliest of all, and, travelling through solid rock with a far greater velocity than in air, often reach the ear before the tremors of the earthquake-wave itself are noticed. Thus an observer often first hears a low and distant rumbling, then feels the tremors before the shock, then the great *shove* of the shock itself, and, lastly, the tremors with which it departs along with the sound. The order of the phenomena must also depend largely upon the distance and form of the focal cavity; the inclination of its plane towards or away from the observer; and many other circumstances, such as the physical, geological, and topographical character of the intervening country.

It is extremely desirable that your correspondent,

and, indeed, any others who have any interest in the solution of the extremely intricate problems connected with the study of such phenomena, should send their observations to the U. S. geological survey. Very many observers who could easily give information which might be of great value when compared with other reports, often hesitate to do so because in itself it seems too vague or meagre to be worth the trouble. EVERETT HAYDEN.

U. S. geological survey, Oct. 18.

Barometer exposure.

In connection with the recent discussion of barometer exposure, the following results of observations made during the high wind of Oct. 14 may be of interest. The barometers are kept in the transit-room, east wing, of the observatory, and windows at north and south were open at the top a foot or more, allowing free access of outside air.

At 7 o'clock A.M. the reduced barometer reading was 29.181 inches, the lowest for many months. At 10 o'clock, when the wind (directly from the west), as indicated by a Robinson's anemometer and Gibbon's recorder, suddenly increased from five to thirty miles per hour, the reduced height was 29.199; and a constant increase was observed for the remainder of the day, although the wind velocity was nearly constant for four hours.

I carefully examined the barometer (Green, No. 2006) for sudden changes in height, and was able repeatedly to detect and measure with the vernier oscillations of .02 of an inch, and at one time a movement of .029 of an inch. The majority of these oscillations did not last over 1.5 seconds; a few as long as 2 seconds.

It was noticed in nearly every instance that the oscillation did not follow immediately upon each gust of wind, but about five or six seconds later. It is possible that the situation of the east wing, sheltered by the main building and dome, may have influenced the result. CHAS. A. BACON.

Beloit, Wis., Oct. 15.

A large squid.

The U. S. fish commission schooner Grampus, which recently arrived at Wood's Holl from a cruise to the eastern fishing-banks, brought in, among other things, a fine specimen of the large broad-finned squid, Stenoteuthis megaptera, Verrill. Although much smaller, this is next in size to the giant squids, and much larger than the common varieties. The one brought in by the Grampus is the first perfect specimen obtained in this country, and the second of its kind in the world. It is also slightly the largest, and, because it was taken alive, is probably the best preserved specimen extant.

The first known specimen was cast ashore near Cape Sable a number of years ago, and is now in the Provincial museum at Halifax. Since then four fragments of this species have been obtained by the Gloucester fishermen, and presented to the national museum, these consisting only of jaws and single arms. It therefore follows that the fine specimen of this animal which has now been secured by the fish commission will be a valuable acquisition to the collections in the national museum.

It was caught on a squid jig of the ordinary pattern, by John F. McDonald, one of the crew of the schooner Mabel Leighton, of Gloucester, on the night of Sept. 25, while he was fishing for the common squid, Ommastrephes illecebrosus. At that time the vessel was off the southern part of Lee Have Bank, in north latitude 42° 45′, and near the 64th meridian of west longitude. When fresh, the total length of the specimen was fifty-two inches from tip of tail to extremity of longest pair of tentacles, while its largest circumference was fifteen inches. The Halifax specimen was forty-three inches long from tip to tip, after having been in alcohol several days.

On the next day after the squid was caught, the Mabel Leighton met with the Grampus, and Captain Greenwood, of the former vessel, presented the animal to the officers of the fish commission schooner.

In this connection it is only just to remark that the Gloucester fishermen have exhibited a very intelligent interest in making collections for the commission. They are frequently able to detect peculiarities in unfamiliar species, and to save rarities. In consequence, their 'aids to science' have been of great value to many specialists in their study of the marine fauna off our coasts. J. W. COLLINS.

Wood's Holl, Oct. 15.

Visual illusion.

In *Science*, No. 176, doubt is expressed concerning the visual illusion noticed by M. Charpentier before the French academy: "After a small, feebly illuminated object has been attentively viewed for some time in complete darkness, it will often appear to move in some determined direction in the field of vision, at a speed varying from two to three degrees per second, and sometimes through a distance subtended by an angle of thirty degrees or more." This illusion has been frequently noticed by me during the last fifteen or twenty years. The motion is usually vertically upward; occasionally the object seems to retrace its path, moving downward, but only after very attentive observation. Recently I have made repeated trials of this illusion, with exactly the same results as were obtained years ago, before I had made the eye a subject of special study.

A. H. COLE.

Hightstown, N.J., Oct. 16.

The significance of coincident weather-conditions.

On Oct. 14 there was an outbreak of violent storms in Europe and America. As was suggested in my letter published in *Science* for Aug. 13, such an event affords an opportunity to test the theory that there is a relation of some sort between disturbances on the sun and storms on the earth. If this relation does exist, the sun should be disturbed in proportion to the magnitude of these exceptional atmospheric movements. That this was the case on Oct. 14 is shown by the fact that on that day there was an extremely rapid formation of spot-groups in the sun's eastern quadrant. On Oct. 15 the number increased to such an extent that on the 16th the entire group was fairly comparable to that which was visible during the great storms in May. During the great gulf storm just previous to Oct. 14, there had been various solar disturbances which upon that date had disappeared, for the most part, by solar rotation.

M. A. VEEDER.

Lyons, N.Y., Oct. 16.

SCIENCE.—SUPPLEMENT.

FRIDAY, OCTOBER 22, 1886.

THE PROGRESS OF NEW ZEALAND.

THE very interesting paper by Sir Robert Stout, premier of the colony of New Zealand, lately read before the Statistical society of London, and now published in the journal of that society, deserves a wide notice, not only because of the interest of the facts and figures adduced, but because of the scientific way in which they are exhibited and discussed.

New Zealand has passed through several distinct economic eras, said the speaker. In the earliest days it was looked upon as the seat of the whale-fishery in the Pacific, and whalers from all parts of the world were found in its harbors. Following the whale-fishers came traders who bartered with the Maoris. After this came the settlements founded by the New Zealand company; and the result was the active pursuit of agriculture, the products being sold to the gold-diggers of Victoria. Pastoral pursuits also became of importance, and an export trade of considerable amount sprang up. But in 1861 the gold-fields in Otago were discovered; and the rush of adventurers to New Zealand soon swelled the population to such an extent that there was a home consumption for every thing that could be raised, and not only did exports cease, but food-supplies had to be obtained from abroad; and while Chili and South Australia provided wheat and flour, England was drawn on for dairy-products, hams, etc. After 1864 agriculture in New Zealand developed much more rapidly, and more lately a number of manufacturing industries have been built up.

At the end of 1884 the colony's population was 564,304, of whom 306,667 were males, and 257,637 females. In addition, there are perhaps 45,000 Maoris. In 1881, when an accurate census was taken, 45.60 per cent of the population were born in New Zealand, and the percentage of native-born New-Zealanders goes on increasing. According to the same census, 41.5 per cent of the inhabitants belonged to the Church of England, 23.09 were Presbyterians, and 14.08 Roman Catholics. In 1884 the colony's birth-rate — proportioned to each 1,000 of the population — was 35.91; the death-rate, 10.39; the marriage-rate, 6.87. This marriage-rate is lower than that of any of the other Australasian colonies. Of those whose occupation was determined by the census enumerators, we find that 70,926 were engaged in trade, commerce, and manufactures; 54,447 in agricultural and pastoral pursuits; 14,273 in mining; 10,233 in the educated professions; 41,635 in ordinary labor, domestic service, and miscellaneous.

Education is well cared for under the general education act of 1877. Of persons between fifteen and twenty years of age, 97.48 per cent are able both to read and write: after twenty years there is a decrease in this percentage, but it is slight. There are 24 secondary schools in operation in the colony, the number of pupils enrolled being 2,577, and the annual expenditure on secondary education 71,517 pounds sterling. New Zealand university is solely an examining body: it confers degrees, but employs no teachers. The teaching-work of the university is done by five affiliated institutions at Dunedin, Christchurch, Auckland, and Nelson. The number of university students in 1884 was 499, and the expenditure for university education £26,815. The expenditure in primary education was £363,316 (including £49,769 on buildings), the number of pupils enrolled amounting to 96,840. The colony supports one civil policeman to every 1,293 of population. The number of offences against the person was, in 1884, 871, or 1.57 per 1,000 of population; and the proportion of offences against property, 2.14 per 1,000. This is a better showing than that made by any of the neighboring colonies. The amount of juvenile crime is very small; and Sir Robert Stout attributes that to the elaboration of the industrial school system, now a permanent institution in the colony.

The government has three industrial schools under its control, and also occasionally supports children at private institutions. Children committed under the industrial school system are of three classes: 1°, those who have themselves done wrong; 2°, those who were in destitute circumstances; 3°, those whose parents have either done wrong or neglected them. The total number committed in 1884 was 313.

As to illegitimacy, — a test often applied to determine the morality of a community, — New Zealand compares favorably with other colonies, though there is an increase in illegitimate births as the colony grows older, and as the population grows more dense in the cities. In 1884 the illegitimate births averaged 2.95 for every 100.

The larger settlements are well supplied with libraries and museums, and the desire for reading-matter is increasing. In 1884 books to the

value of £115,246 were imported. This does not include magazines, newspapers, and books sent by post. There are 172 newspapers published in the colony, — 49 daily and 91 weekly, bi-weekly, and tri-weekly, — or 1 to every 3,281 inhabitants. In England and Wales the ratio of newspapers to population is 1 to 13,828; in Ireland, 1 to 32,585; in Scotland, 1 to 21,013; and in the United States, 1 to 4,656.

New Zealand now enjoys direct steam-communication with England by two lines, and there is a fine mail-service running monthly to San Francisco. In 1884 the number of ships entered inwards was 852 vessels of 529,188 tons: of these, the United States was represented by 23 vessels of 10,935 tons. The shipping outwards was 872 vessels of 534,242 tons; of these, 9 vessels of 4,086 tons belonged to the United States. The value of the exports was 7,091,667 pounds sterling, and that of the imports 7,663,888 pounds sterling.

The mining interests will probably increase as new capital flows in to enable the fields — other than the shallow alluvial deposits — to be worked. The value of the gold product since the opening of the mines has been £42,368,192; the amount exported in 1884 was £988,953. The fall in copper has had an injurious effect upon the copper-mines, and their production has been very large. The main development of the past twenty years in mining has been the production of coal. In almost every province of the colony are to be found extensive brown coal deposits. In 1884 the number of tons produced was 480,831. There is a strong probability that early attention will be paid to silver, shale, tin, and the other mineral developments of the colony.

In 1864 New Zealand exported 16,691,666 pounds of wool: in 1884 this had increased to 81,139,018 pounds. In the same time the number of sheep had increased from 4,937,273 to 14,056,266; the number of cattle, from 249,760 to 700,000; of horses, from 49,409 to 170,000; of pigs, from 61,276 to over 200,000. In connection both with pastoral and agricultural pursuits, there has grown up the exporting of frozen meats, and this has encouraged the rearing of sheep on lands formerly used for grain-raising.

The area of land alienated from the crown was, in 1864, only 7,759,954 acres: in 1884 it amounted to 17,692,511 acres. In 1884 no fewer than 6,391,075 acres were under crop and sown grasses. In 1864, as was stated above, New Zealand not only exported almost no agricultural products, but drew its food-supplies largely from abroad. But in 1884 the exports included, wheat, 2,706,775 bushels, valued at £436,728; barley, 128,450 bushels, worth £25,138; malt, 51,311 bushels, worth £14,665; and oats, 2,474,613 bushels, worth £267,286. The exports also included £33,324 worth of flour, £53,536 worth of potatoes, and 254,069 hundredweight of frozen meat, valued at £345,090.

Agriculture is now seeking other outlets: orchards are being planted, tobacco is raised, and linseed is now produced. The area of forest-lands is 20,000,000 acres, and of this area 9,000,000 acres contain useful timber-trees.

The manufacturing establishments are of so recent a date that statistics have not been obtained concerning them; but during this year it is proposed to determine accurately their number, the amount and value of the goods produced, and the number of workmen employed. For manufacturing purposes, New Zealand has the unusual advantages of a moderate climate, a large coal-deposit, and ample water-supply in almost any part of the colony.

The wealth and material prosperity of the colony are rapidly increasing. In 1881 there were, in all, 103,335 houses, of which 87,646 were wooden. In 1884 the savings banks had on deposit £1,926,005, and the ordinary banks £9,372,004. One person in every seven holds a life-assurance policy, — a larger percentage, probably, than obtains in any other country. The value of the personal property that is taxed is 40,000,000 pounds sterling, and the value of the real property held by the colonists is 75,000,000 pounds sterling. 1,527 miles of railway are in operation, and 10,474 miles of telegraph-wires; and 1,961 telephones are in use. The number of letters carried in 1884 was 16,611,959, and the number of telegrams sent 1,654,305. Gas is used in 27 incorporated towns. The colony's revenue in 1884 was £3,955,188, and its expenditure £4,101,318. The large expenditure was due to the fact that large sums were borrowed for the prosecution of public works. The total public debt is £30,649,099, but of this a large proportion has been spent on public works which are now returning a good interest.

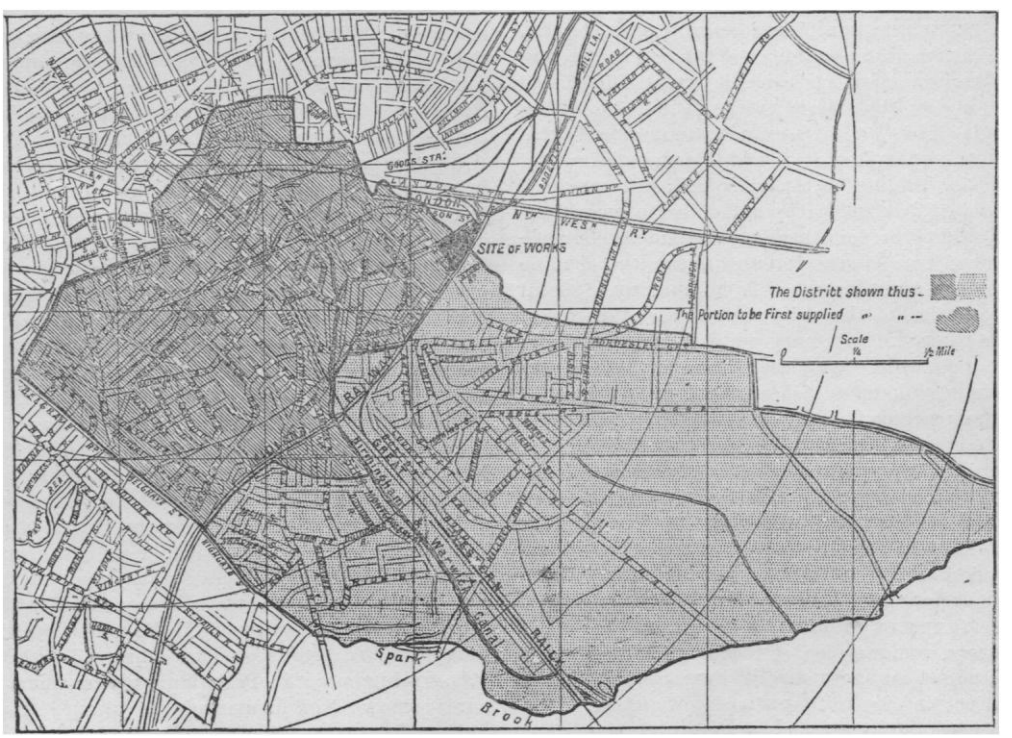
Sir Robert Stout predicts that this splendid progress will be maintained, and that population will rapidly increase. Agriculture will become more varied and be diligently prosecuted, dairy farming will come into prominence, and mining will increase. He thinks, too, that the record of the next twenty years will show an advance rather greater than less than that which his valuable paper describes.

DISTRIBUTION OF POWER BY COMPRESSED AIR.

Air at a pressure of forty-five pounds to the square inch will, in the near future, displace steam as a motive power in many of the smaller manu-

facturing establishments of Birmingham, England. The air will be compressed at a central station, and supplied through street mains, much as gas and water are now distributed, taking the place of steam for driving engines. Steam has long been distributed from a central station in this city with economy and safety, and there is no reason why compressed air should not be distributed in a similar manner. The Birmingham company, which has charged itself with this enterprise, will begin operations with a plant capable of supplying fifteen thousand horse-power, six thousand of single-acting air-compressors, capable together of delivering two thousand cubic feet of air per minute at forty-five pounds pressure, will be driven by each engine, making a total capacity of thirty thousand cubic feet per minute. Six million gallons of water per day will be required for the boilers and condensers.

The street mains will be of wrought iron, laid in concrete troughs with removable covers, not far below the surface of the street. Valves will be fixed at intervals in the mains, to automatically shut off the air in case a section of pipe



POWER DISTRIBUTION BY COMPRESSED AIR, IN BIRMINGHAM, ENGLAND.

which have already been contracted for. The accompanying illustration shows the district covered by the first plant, the darker portion being that which will be first supplied with power. This area will require about twenty-three miles of mains, ranging in diameter from seven inches up to twenty-four. The central station is located between a railroad and a canal, so that coal and water are readily obtainable. The coal will be converted into gas, which will be then used as fuel under the boilers, of which there will be forty-five, supplying steam to fifteen triple expansion engines of one thousand horse-power each. Six should burst; the same valves serving as stop-valves, which can be closed by hand, if desired, through man-holes in the street. The compressed air delivered to customers will be measured by meters, and charged for by the thousand cubic feet, a special device in the meter compensating for any variations in pressure. The total amount used will be registered on a dial at the central station by electric apparatus.

A paper upon the Birmingham compressed air scheme was read before the British association on Sept. 8 by Mr. J. Sturgeon, in which he showed that the large number of engines of moderate

size used in Birmingham, often intermittently, renders the system peculiarly applicable to that city. Although each thousand horse-power at the central station may produce only five hundred horse-power at the users' engines, it will displace fully a thousand horse-power of small boiler plant, etc., while the centralization of the power-producing plant admits of the conversion of fuel into power under conditions most favorable to economy and efficiency.

THE MENTAL FACULTIES AND SOCIAL INSTINCTS OF APES.

A WRITER in the *Revue scientifique* (Aug. 28, 1886) has made an admirable *résumé* of the suggestive analogies between the mental habits of the higher quadrumana and those of low savage tribes, and to some extent of civilized children. The importance of this stage in mental evolution has not been overlooked; but much of the material is unreliable, and direct observations by good observers are few. Mme. Clémence Royer gives copious references to the best of these observers, and thus succeeds in making a useful presentation of the subject in a very few pages. Even the mere summary which is here to follow, of the points in common to the ape and the savage man, will be sufficient to impress one with the far-reaching extent and real significance of this comparison.

Sociability and the family. — The degree of sociability varies greatly in different species. The gorillas of West Africa live in small patriarchal families, while the cynocephalus and many American species live in troupes, without any definite sexual relations. Savage tribes showing each of these forms of family life have been described. Houzeau remarks that the patriarchal system is maintained among many of the anthropoid apes by subordination to the authority of a chief. Each group has but one chief, — an adult male. The females and young ones are subject to his control until they tire of this dependence, and abandon or kill the ruler. Among the chimpanzees and gorillas, even smaller families, with a single pair at the head, are found; and here the feelings of maternal and conjugal love are developed to a high degree. Paternal affection is rare, but many savages do not recognize the right of the father. It is common to find them tracing descent through the female line only, without any regard to paternal instincts. Three authenticated examples of conjugal love among apes are recorded.

Language. — By this term must be understood, not a finished systematized speech, but simply some rudimentary mode of expressing emotional and mental states by sounds and gestures. Apes, of course, have cries for all their common emotions, — their desires, their fears, pains and pleasures. These cries differ considerably in different species. Houzeau records an instance in which the animal used a special cry when it was displeased by having an object given to it which was not the one it wanted.

The faculty for imitation is certainly characteristic of the quadrumana, and has given us the phrase 'to ape.' It is a trait common to savages, to children, and to idiots; in short, to low-type, undeveloped minds. The attitudes and general conduct of apes are so human, that some savages believe that it is only out of spitefulness that they do not speak. But even this poverty of sounds is not without parallel in savages: many have a very meagre alphabet of sounds, and help themselves out with clicks and natural noises. All apes (except, perhaps, the orang-outang) have voice: they often repeat sounds, which are usually complex articulations involving gutturals and harsh sounds, with little variation. But the New-Zealanders lack twelve of our consonants, and other tribes show similar imperfections. And, curiously, it is just the labials so often found absent in the languages of the lowest species of men that are never used by apes. But the labial *m* is almost the first sound learned by the civilized chief, as is shown in the word 'mamma.'

Apes readily understand our language sufficiently to be tamed, and trained to astonishing performances; and they are guided by sound as well as by gesture. Perhaps they understand our language somewhat as a child of fifteen or eighteen months understands its mother. But of course they lack every trace of a method of recording mental conditions. If the most primitive savage had not had some sort of record-making, even so simple as the Peruvian *quipus*, we could hardly know of his existence.

The phrase of Rabelais, that 'laughing is a peculiarity of the genus Homo,' is shown false by the evidence of this power in apes. It may be noted that many half-civilized people laugh very seldom, such as the Turks. One can readily read the expression on an ape's countenance. They weep too, and have been observed to frown.

Fêtes and funeral rites. — Houzeau likens the assemblages observed among the quadrumana to those of the Hottentots and other people. The apes of South America, when they have drained the resources of a certain area, have a re-union before they decide to emigrate. They jump and run and shout; the males running along the trees, while the females carry the young ones in their arms. Stories are told of the regularity

with which such re-unions are held. In Africa the apes, on such occasions, collect sticks, and make a noise by hammering on the trees: the analogy with primitive music-making is sufficiently evident.

The Chinese tell of a species of ape that accompanies the body of a deceased member to its final resting-place, but this may be doubted. The Caffres of Africa, however, do not take the trouble of burying their dead, except in the case of chiefs or children.

Weapons and contests. — Apes, like men, fight and kill one another. The leader is the one who has shown his strength. When the male gorillas grow up, and have gained the full degree of their power, they attack the old ones, and do not leave the field until the issue has been decided. The abandoning of the aged is a custom in many tribes. Herodotus records it of certain people of Scythia. The gap between the lowest human morality and that of animals is small indeed.

Their fights are mostly hand to hand, with an active use of their canines, though some species very seldom bite. The Spartans are said to have fought with tooth and nail when deprived of their arms. The gorilla's method of attack is most nearly human. He raises a cry like the war-whoop of savages, and, beating his breast with his hands, rushes with savage ferocity upon his antagonist. With the exception of the gorilla, the quadrumana fear man, but do not hesitate to attack him in self-defence.

The hurling of projectiles, whether lances, tomahawks, or clubs, and so on, is common to all savages, and is likewise found among apes. They tear off branches of trees and use them as arms, or take refuge in the trees and hurl fruit at their enemy. This means of attack is found even in high degrees of civilization, as in the middle ages, and is made use of by animals (e.g., elephants) lower in the animal scale.

Friendship, enmities, etc. — Individual preferences can be observed among apes at any zoölogical garden. Their affection for their keepers is well known. They have aversions too, sharing with man the dread of snakes. Tribal enmities are also observed: the orang-outang has an instinctive animosity against almost all other apes. Similar feuds abound in savage tribes. Apes readily show temper, and have often been compared to spoiled children. Their anger is expressed by cries and wild gesticulations.

Apes readily drink wine when it is given them, and quite as readily drink to excess. Their conduct, when inebriated, is closely similar to that of man in the same condition.

Though antipathies are common between apes of different species, friendly assistance is often shown among apes of the same species. They join to ward off a common danger. The hand is the great means of giving aid: we have the expression 'to lend a hand.' It is true in a general way that species provided with organs of apprehension are sociable. Apes often plan attacks on orchards, etc., reach inaccessible places by forming a living chain and bridging themselves over, and seem to delight in the act of theft. They have been observed to take care of the wounded, to wash and cover their wounds with leaves, and to nurse them.

Intelligence. — The possession of acute sensibility for foreseeing danger, and the like, is a common animal trait, not wanting in apes. The similar sagacity of savages, e.g., our own Indians, is well known. Apes soon learn the danger of fire-arms; and the story is told of one who dropped from a tree when he saw that his assailants were armed, apparently giving himself up as dead.

An ape's curiosity and power of fixed attention are well known: these qualities are necessary to make a good imitation. In several cases they have observed the use of a lock and key, and made use of their knowledge in secret. Chimpanzees have been taught to eat with a knife and fork, and learn similar human customs. Their tendency to pilfer is another point in common with savages and children.

Industry. — Man has been called the tool-using animal; but apes have been observed to use a stone for opening nuts too hard for their teeth. Erasmus Darwin tells of an old ape who had lost his teeth, and always used a stone to open nuts.

Apes can be taught to mount and guide horses and dogs; and one traveller tells a story of an ape who learned this of his own accord, thus reminding one of the savage's method of procuring horses. Humboldt records similar observations. The stories of apes kindling fires are unreliable, though they often keep up fires deserted by natives or travellers.

Domestic services. — Apes have been used for carrying water and as bearers of messages. A French officer tells of the services of a chimpanzee aboard ship. It helped turn the capstan, climbed the masts, tied the ropes, and performed other functions. But only a few species are adapted for such an education.

Richard Owen, comparing the psychic condition of a chimpanzee with that of a Bushman or an idiot, finds no clear dividing-mark. It is only a difference of degree. Agassiz finds a complete resemblance between the mental faculties of an infant and of a young chimpanzee. It is only by the greater development of the former that it

becomes human with all the great distinctions of that term.

ANTHROPOMETRICAL TESTS.

SINCE Mr. Francis Galton conducted his anthropometrical measurements at the International health exhibition, increased attention has been given to the measurement of physical characteristics and of the senses. Mr. Galton has received letters from Tokio, from Rome, from Paris, and elsewhere, asking for the necessary apparatus for establishing a laboratory where the important measurements of the body and testing of the senses can be made.

The importance of such observations is well understood. It will enable us to determine accurately racial characteristics, to mark the stages of individual growth, to detect abnormalities of development in time to check them, to lay the foundation for a rational education of the senses and the muscles.

Mr. Galton has been devoting much time to the preparation of instruments for measuring the head and the delicacy of the senses; and Mr. Horace Darwin, of the Cambridge scientific instrument co., has aided him in the work. The last Journal of the Anthropological institute of Great Britain contains a preliminary account of some of their devices.

As regards the size of the head, it is well known that the caps of university students are larger than those of the uneducated population. With a convenient method of determining the size of the head in various directions, one could find at what age generally and individually the growth of the brain comes to a standstill. The method of taking the measurements is still a matter of controversy. The maximum breadth can be gotten by a pair of calipers, with rough teeth, like those of a comb, to penetrate the hair. The maximum length from the glabella (the central point between the eyebrows) is also easy to measure. The great difficulty is in getting the height of the head. Mr. Darwin's instrument for this purpose is inserted into the two ear-holes, and a slight projection is caught by the inner edges of the orbits: this determines the horizontal plane, and measurements are taken to either side from it. He will improve the instrument by having a band attached, to be inserted under the chin, and thus press the frame close against the orbit.

For the color of the eyes and hair, Mr. Galton suggests, instead of printed shades, which are apt to fade, small disks of colored glass for the eyes, and spun threads of this glass for matching the hair.

The usual form of dynamometer for measuring the force of one's grip is objectionable, because the maximum clutch depends on the width and convenience of the instrument at its widest point. Mr. Darwin is making an instrument to avoid this defect.

With regard to sight, Mr. Galton admitted that there was no good recognized way of measuring the acuteness of vision, but thought the simple method of getting the distance at which one can tell in what corner of a white card a black dot is to be found, as good as any. Mr. Brudenell Carter, who has published some interesting views on the relation of eyesight to civilization, objected to this method, and preferred the test of distinguishing two closely adjoining dots. There are many good methods of testing the color-sense; and Dr. Cattell's experiments at Leipzig, on the time it takes to perceive the various colors, are of interest here. He found that it requires 8 ten-thousandths of a second to see orange, 10 to see yellow, 12 to see blue, 13 to see red, 14 to see green, 23 to see violet. The exposure was made by an arrangement similar to the instantaneous shutter of a camera. Great individual differences in the perception of various colors appeared, and a simple form of his apparatus might be useful for testing the color-sense.

With regard to sounds, we have almost no exact methods of measuring. The susceptibility to pitch can be readily measured.

Mr. Darwin also exhibited before the Anthropological society an ingenious contrivance for measuring one's reaction time, which works on the principle of snapping a rod, and arresting it in its fall as soon as possible after the sound is heard.

The subject is really one of the highest practical importance, and physiological as well as mechanical problems are involved. A physiologist with a mechanical bent would certainly find here a fruitful field.

THE STUDY OF THE SENSES.

THE great name of Helmholtz stands for the union of the physical and biological sciences. The late Professor Clifford speaks of him as "the physiologist who learned physics for the sake of his physiology, and mathematics for the sake of his physics, and is now in the first rank of all three." In his 'Physiological optics' and his analysis of the 'Sensations of tone,' he gave to the world two classical works, as invaluable to the physicist as to the psychologist and physiologist. The real greatness of these studies, the new engine that he employed, consisted in recognizing the dual nature

of all phenomena, and attacking his problems from both points of view. To the physicist a body is a piece of matter exhibiting certain properties under certain conditions : to the psychologist it is a complex of sensations. For many purposes it is advisable to keep these things separate. But the convenience arising from this separation gave rise to the false notion that the two things had little or nothing in common, and, if useless metaphysical questions were to be avoided, had better have little in common. It was an example of over-specialization. Helmholtz showed, that, apart from any metaphysical notions or discussions, a large common field lay open, where the combined forces of physics and psychology could and ought to unite to shed new light on a most important department of scientific research.

Helmholtz was not long without followers in his rich line of work, and foremost among these is Professor Mach of the University of Prague. He, too, is a physicist, but was constantly driven to a study of the senses by the wide point of view from which he regarded his science. He is best known as a psychologist by his study of the sensations accompanying motion. In these he contrived an ingenious apparatus by which persons were swung around in various directions, and the inference drawn from the nature of the vertigo caused by the revolutions, that the semicircular canals of the internal ear, which experiments on animals had shown to be a mechanism for maintaining equilibrium, served a similar function in man. He has also repeated and added to the analysis of tone sensations which Helmholtz made. His work is characterized throughout by an unusual ingenuity, great accuracy, and a clear and easy exposition.

In a recent publication [1] he has added some highly suggestive studies in the sphere of sight and hearing, and accompanied them by a statement of the point of view from which he regards the study of the senses. It is to the latter that attention is to be briefly called.

" Through the deep conviction that science in general, and physics in particular, is to expect the next great advancements with regard to its fundamental position from biology, and more especially from the analysis of sensation, I have been repeatedly drawn into that field." This the opening sentence of his preface may be regarded as a text. Before proceeding with his argument, he wants to clear the ground by a few ' anti-metaphysical ' remarks. In the first place, as to what a thing is. It is what can be perceived by the mind at once : it is this that gets a name. An apple is a complex of visible, tangible, smellable, tastable qualities. One's self is a more constant complex of such and other sensations associated with the body. By a comparison of various such complexes of sensations, we analyze them, and divide off the visible, tangible, etc. The visible, again, we divide into form and color, and these are our elements. The body is only the sum of the sensations to which it can give rise. The illusion that because we can abstract each of these sensations separately, and still retain the body, we can do so with all at once, has given rise to the metaphysical ' thing *per se*.' The chasm between physics and psychology exists only in our stereotyped mode of presentation. A color is a physical object when we consider its dependence on the source of light, its relation to other colors, its heat-giving properties, etc. : it is a psychological object when we consider its dependence on the retina. In the first case we trace a relation between two series of phenomena : in the second case one of the series is replaced by a third, of different nature. It is the point of view that makes the difference. We avoid the conflict between the physical and psychological points of view by considering sensations as the ultimate elements. This, too, is not to be regarded as the permanent, but, as for present purposes, the most economical position.

The sensation, in turn, can be subjected to a psychological analysis, can be regarded as a physical (physiological) phenomenon, or its dependence on physical processes worked out. The latter, whenever possible, is the ideal goal to be reached. Our guiding principle is that of a complete parallelism between the psychic and the physical. At times, it is true, more light will be gotten from a purely biological (evolutionary) point of view ; but this, again, can be formulated under the general rule.

The advantages that physics is to gain from such considerations are many. In the first place, a false conception is eradicated. There is no subject and object, no thing and sensation. Only one kind of elements exists, from which subject and object are built up. The ' sensible ' world is the common property of physics and psychology. It is physics as long as we disregard our own body : it is psychology when that is the special object of research. Again, the physicist will no longer be misled by such imposing entities as matter, atoms, etc. He will recognize their purely secondary and symbolical origin.

An adaptation of our method of thinking to the facts is the end of science. This goes on unconsciously in the daily life of every one : it is education. When raised into a conscious and deliberate object, it becomes scientific research. If

[1] *Beitrage zur analyse der empfindunger*. VON DR. E. MACH. Jena, 1886.

the facts of nature really are as here represented, the gaining of this new point of view must be regarded as a distinct advance in this adaptation.

From the above unsatisfactory [1] sketch of Professor Mach's position, it may perhaps be seen that he regards a great psychophysic movement in science as the next revolutionary process. Many signs of such a movement are already evident.

J. J.

A MANUAL OF NORTH AMERICAN BUTTERFLIES.

ALTHOUGH a really good manual of our butterflies has long been a desideratum, Morris's Synopsis being altogether out of date, it cannot be said to be supplied in the present work.

The whole aim of the author seems to be to enable his reader to find out the name of a specimen in hand; and to this end his 'analytical key' is fairly good, so far as the perfect insect goes, excepting, that as no tables are given for genera, families, etc., it would not help the student if species not included in the book were to turn up. The key is also faulty, because largely made up of very unimportant characters, and because it takes no account of the earlier stages; indeed, no means whatever are anywhere furnished for finding out the affinities of a caterpillar or chrysalis in hand, except by wading through all the descriptions in the book.

We fail to see how the work can be of any possible pedagogical service, although this is claimed as its chief end. For, first, the only clew it gives to the classification, i.e., the natural arrangement of butterflies, is in the brief statement that is presented of the characters of some of the higher groups, and, incidentally, in the actual arrangement of the species treated; there is scarcely a reason suggested why the sequence of the groups should be as it is; it is simply stated in the preface that Edwards's arrangement is followed, yet Edwards has never offered a reason, but only printed a bare list. Second, the arrangement itself is unnatural, holding its ground only through precedent, as a legacy from the less-informed authors of fifty years ago. Third, the whole aim of the author appears to be to enable the user to answer the question, 'What is the *name* of my butterfly?'— for pedagogical purposes not even a worthy, far less the best end.

The genera are nowhere characterized; the descriptions of the butterflies could be much improved by more concise and methodical expression and the italicizing of the most distinctive features; the early stages of a considerable number of species are omitted, when they have been known and published for many years; and, finally, there is not a line or suggestion throughout the book which would lead one to suspect that science had changed within the last eventful quarter-century. It is but the rehabilitation of the dry husks of a past generation.

[1] The account is perhaps unavoidably so; as it was the task of the reviewer to avoid the technicalities of the psychological part on one side, and of the physical part on the other.

The butterflies of the eastern United States, for the use of classes in zoölogy and private students. By G. H. FRENCH. Philadelphia, *Lippincott*, 1886. 12°.

SCRANTON is the centre of what is known as the northern anthracite coal-field of Pennsylvania, comprising nearly two hundred square miles. Using this fact as a fulcrum, and taking for a lever the fact that natural gas has to a great extent displaced coal in Pittsburgh, the Scranton board of trade are endeavoring to lift their home into prominence as one of the great manufacturing cities of the future. In a neat pamphlet recently published by the board, it is pointed out that gas is a more economical fuel than coal; that the supply of natural gas will soon be exhausted; that there are forty million tons of culm, or coal-waste, — which may be had for the taking, — lying about the mines of the Scranton region; that this amount is being increased by two million tons annually; that gas may be made from this waste at a cost of two cents per thousand feet; that in the near future coal will probably be converted into gas in the mines, and piped to the surface; that gas-engines are steadily growing in favor; and that Scranton is already a great railway centre, with excellent shipping facilities to all points of the compass. The conclusion is inevitable, at least to the publishers of the pamphlet, that Scranton is a very desirable place for the establishment of industries requiring cheap fuel and power.

— An experiment with a new hydro-carbon fuel burner for locomotives was recently tried on the Third Avenue elevated railroad in this city. The burner is about six inches in length by five in diameter. A spray of petroleum and steam was forced through perforations in the burner, producing a large volume of flame; but, through inability to control the draught of the furnace, combustion was imperfect, and the experiment was a failure. This was only one of a long series of experiments with similar devices, none of which has succeeded. As the consumption of coal on the locomotives of the elevated railroads averages only two and six-tenths pounds per horse-power developed, there would seem to be no field for the economic substitution of petroleum at present prices.